Sample Memory Aids

MTH

4151 4152 4153

Developed by Jessica Lee, Math & Science Specialist
First Nations Regional Adult Education Centre
Kahnawake

Contact for questions or requests to modify elements for your learners.

Find and use a linear equation

x	2	4	6	8
y	10	15	20	25

$1^{st} diff.$ $15-10 = 5$ $20-15 = 5$ $25-20 = 5$

First differences ($y_2 - y_1$ etc) are the same, indicating it is a linear function.

Use any two sets of coordinates (x,y) to find the rule/equation $y = ax + b$

$a = \frac{y_2-y_1}{x_2-x_1} = \frac{25-10}{8-2} = \frac{15}{6} = 2.5$

$y = ax + b$ (replace y, x and a)

$10 = 2.5 \cdot 2 + b$

$10 = 5 + b$

$10 - 5 = 5 = b$

Equation: $y = 2.5x + 5$

If $x = -6$, find y

$y = 2.5(-6) + 5 = -15 + 5 = -10$

Find and use a quadratic equation

x	2	4	6	8
y	2	8	18	32

$1^{st} diff.$ $8-2 = 6$ $18-8 = 10$ $32-18 = 14$

$2^{nd} diff.$ $10-6 = 4$ $14-10 = 4$

Second differences are the same, indicating it is a quadratic function.

Use any set of coordinate (x,y), but not (0,0) to find the rule/equation $y = ax^2$

Replace x and y and find a

$y = ax^2$ $8 = a \cdot (4)^2$ $8 = a \cdot 16$

$8 \div 16 = 0.5 = a$

Equation: $y = 0.5x^2$

If $x = -6$, find y

$y = 0.5(-6)^2 = 0.5(36) = 18$

On the calculator to enter -6^2

(-6) y^x 2 and should always be positive!

Find and use an exponential equation

x	2	3	4	5
y	14.4	17.28	20.736	24.8832

First and second differences are not the same so it is NOT linear nor quadratic function.

The only choice is the exponential function

$$y = a \cdot b^x$$

Use two sets of coordinates (x, y) to find the rule/equation

$b = \sqrt[x_2-x_1]{y_2/y_1} = \sqrt[3]{24.8832/14.4} = 1.2$

On the calculator enter

$(24.8832 \div 14.4)$ 2^{nd} y^x 3

$When\ x = 0, its\ y - value\ is\ 'a'.$

x	0	1	2
y	10	12	14.4

$\div 1.2 = 10$ $\div 1.2 = 12$

Equation: $y = 10 \cdot 1.2^x$

If $x = 6$, find y

$y = 10 \cdot 1.2^6 = 29.86$

On the calculator 1.2^6 is (1.2 y^x 6)

Solving a system of equations

$2x + 5y = 13.15$ and $6x + 2y = 10.20$

Step 1. Isolate 'y' in each equation

$5y = 13.15 - \mathbf{2x}$ $2y = 10.20 - \mathbf{6x}$

then divide everything by 5 then divide everything by 2

$y = 2.63 - 0.4x$ $y = 5.1 - 3x$

Step 2. Compare the two y-values to solve for the x-value

$$y = y$$

$$2.63 - 0.4x = 5.1 - 3x$$

$$-0.4x + \mathbf{3x} = 5.1 - \mathbf{2.63}$$

$$2.6x = 2.47$$

$$x = 2.47 \div 2.6 = 0.95$$

Step 3. Use the x-values to find the y-value

$y = 2.63 - 0.4x$ $y = 5.1 - 3x$

$y = 2.63 - 0.4(0.95)$ $y = 5.1 - x(0.95)$

$y = 2.63 - 0.38 = 2.25$ $y = 5.1 - 2.85 = 2.25$

Then use the x- and y-values to answer the question.

Periodic function

Ex. When x =76, what is the y-value?

1. find the period
2. Divide the x-value by the period $76 \div 8 = 9.5$
3. Take just the decimal value and multiply it by the period

$0.5 \times 8 = 4$

x=76 is the same as x=4

So you can use the graph to answer the question.

Always transforms (like above) just the first value.

Properties of a function

Domain – all x-values, left to right

Range – all y-values, bottom (min) to up (max)

Positive - domain of the part above the x-axis

Negative – domain of the part below the x-axis

Increasing – up, Decreasing – down, Constant-flat

x-intercept – curve on x-axis y-intercept – on y axis

Find the relationship between two linear functions

Extract the m- and b-values.

If $a_1 = a_2$ and $b_1 = b_2$ →parallel and coincident

If $a_1 = a_2$ and $b_1 \neq b_2$ →parallel and distinct

If $a_1 \neq a_2$ and $a_1 \cdot a_2 \neq -1$ → intersecting

If $a_1 \neq a_2$ and $a_1 \cdot a_2 = -1$ → perpendicular

Stem and leaf plot is usually used to visualize a distribution of data.
Ex. 8, 9, 10, 10, 13, 15, 18, 20, 28 from woman
11, 11, 13, 15, 18, 20, 25, 28, 28 from men
*Always provide a title and label every graph!

Costs of skin care products

women		men
9 8	0	
8 5 3 0 0	1	1 1 3 5 8
8 0	2	0 5 8 8

Cups of coffee daily	Frequency
1	20
2	18
3	8
4	5
5	9
Total	60

Mean, mean deviation and range

Using the frequency table as an example

Mean

$= \textit{ add up all the values} \div \textit{total number of values}$

$$= \frac{(1\times 20)+(2\times 18)+(3\times 8)+(4\times 5)+(5\times 9)}{60}$$

$= 145 \div 60 = 2.42 \sim 2 \; cups \; of \; coffee$

Mean deviation =

add up difference of each value from the mean (ignore +/-) ÷ total number of values

$$= \frac{(1\times 20)+(0\times 18)+(1\times 8)+(2\times 5)+(3\times 9)}{60}$$

$= 65 \div 60 = 1.08$

Range = largest value – smallest value.

$= 5 - 1 = 4$

Percentile rank

1st percentile rank includes the lowest values in the group.
100th percentile rank includes the highest values in the group
To calculate percentile rank:

$$R_{100} = \frac{n_{smaller} + n_{same}/2}{n_{total}} \times 100$$

Ex. calculate percentile rank of Jessica who drank 2 cups of coffee a day.

$$R_{100} = \frac{20 + 18/2}{60} \times 100 = \frac{29}{60} \times 100$$

$= 48.3 \sim 49 \; preentile \; rank$

**Always rounds UP*

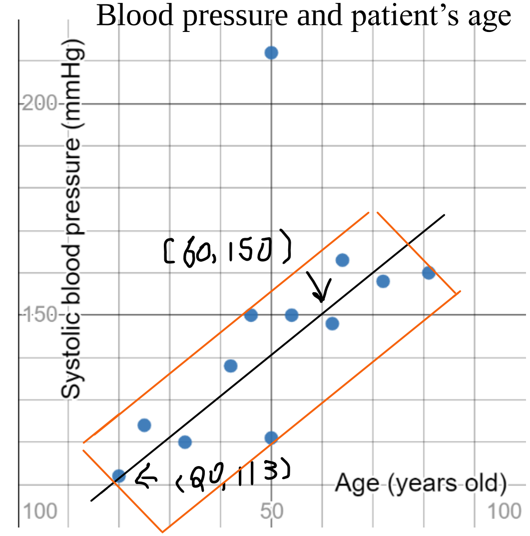
Contingency/correlation table:

- 'x' along the top and 'y' down the left-hand side
- Divide the range by 5 or 6.
- Positive correlation going DOWN (ex below)
- Negative correlation going UP

# of hours vs. money spent

	1	2	3	4	5
[10,20[	II				
[20,30[	I	III			
[30,40[			II		
[40,50[				I	II
[50,60[					I

Blood pressure and patient's age



From a **scatterplot**:

- Graphing area should be square-ish
- Draw a line of best fit, ignoring obvious outliers = linear regression line
- Find the linear equation $y = ax + b$

$$a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{150 - 113}{60 - 20} = \frac{37}{40} = 0.925$$

$y = ax + b$
$150 = 0.925(60) + b$
$150 - 55.5 = 94.5 = b$
$y = 0.925x + 94.5$

- Use the equation to predict. Ex. blood pressure for 100 years old person.

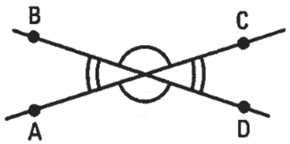
$$y = 0.925(100) + 94.5 = 187 \; mmHg$$

- Use the box method to estimate correlation coefficient (r)

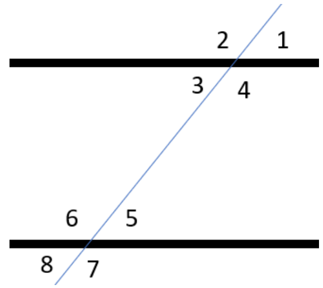
$$r \sim 1 - \frac{width}{length} = 1 - \frac{1.4}{4.5} = 0.69$$

- Correlation is positive and moderate.
- A higher correlation coefficient could mean better correlation, and better prediction from the equation.

Complementary angles add up to 90°
Supplementary angles add up to 180°
Vertically opposite angles are the same.

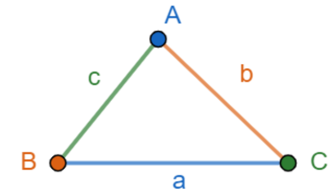


$\angle 3 = \angle 5 \;\; and \;\; \angle 4 = \angle 6$
$\angle 1 = \angle 8 \;\; and \;\; \angle 2 = \angle 7$
$\angle 1 = \angle 5 \;\; and \;\; \angle 2 = \angle 6$
$\angle 3 = \angle 8 \;\; and \;\; \angle 4 = \angle 7$

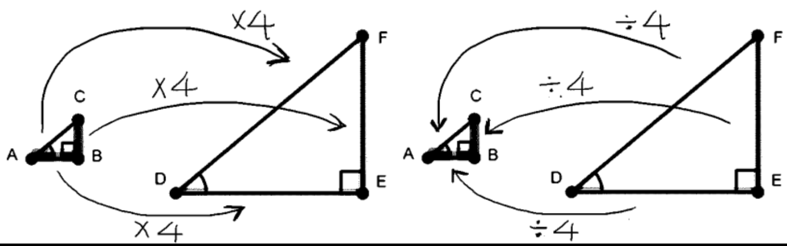


Area of a triangle:
With a base and height: $A = b \times height \div 2$
With all 3 sides: Hero's formula
$p = (a + b + c)/2$
$A = \sqrt{p(p-a)(p-b)(p-c)}$
With two sides and the angle in between:
$A = a \cdot c \cdot sinB \div 2$

Any triangle- P9: Sine law
$\frac{a}{sin\ A} = \frac{b}{sin\ B} = \frac{c}{sin\ C}$
$ex.\ a = b \cdot \sin A \div \sin B$
$m\angle A = \sin^{-1}(a \cdot \sin B \div b)$
Cosine law (optional): $a^2 = b^2 + c^2 - 2bc\ cos\ A$



Congruent (same) triangles:
P1: SSS
P2: SAS
P3: ASA
Similar triangles:
P4: AA
P5: SSS
P6: SAS



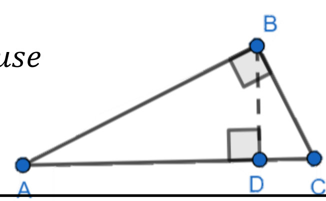
Right triangles ONLY
Pythagorean theorem
$c^2 = a^2 + b^2 \quad c = \sqrt{a^2 + b^2} \quad a = \sqrt{c^2 - b^2}$
Trig. Ratios

$sin = \frac{opposite}{hypotenuse}$
$ex.\ m\angle A = \sin^{-1}(\frac{m\overline{BC}}{m\overline{AC}})$
$m\overline{AC} = m\overline{BC} \div \sin A$
$m\overline{BC} = m\overline{AC} \cdot \sin A$

$\cos = \frac{adjacent}{hypotenuse}$
$ex.\ m\angle A = \cos^{-1}(\frac{m\overline{AB}}{m\overline{AC}})$
$m\overline{AC} = m\overline{AB} \div \cos A$
$m\overline{AB} = m\overline{AC} \cdot \cos A$

$tan = \frac{opposite}{adjacent}$
$ex.\ m\angle A = \tan^{-1}(\frac{m\overline{BC}}{m\overline{AB}})$
$m\overline{AB} = m\overline{BC} \div \tan A$
$m\overline{BC} = m\overline{AB} \cdot \tan A$

Right triangle with the altitude to the hypotenuse - Metric relations
P10: $leg^2 = projection \times hypotenuse$
$m\overline{AB}^2 = m\overline{AD} \cdot m\overline{AC} \;\; or \;\; m\overline{BC}^2 = m\overline{DC} \cdot m\overline{AC}$
P11: $altitude^2 = segment \times segment\ of\ hypotenuse$
$m\overline{BD}^2 = m\overline{AD} \cdot m\overline{DC}$
P12: $leg \times leg = altitude \times hypotenuse$
$m\overline{AB} \cdot m\overline{BC} = m\overline{BD} \cdot m\overline{AC}$



Distance between two points:
$d(A,B) = \sqrt{(x_B - x_A)^2 + (y_B - y_A)^2}$
Midpoints between points A & B
$x_P = \frac{x_A + x_B}{2} \qquad y_P = \frac{y_A + y_B}{2}$
Point P is divides $\overline{AB}$ in $m\!:\!n$ ratio
$x_P = x_A + \frac{m}{m+n}(x_B - x_A)$
$y_P = y_A + \frac{m}{m+n}(y_B - y_A)$
Point P is located $\frac{p}{r}$ of the way from points A to B
$x_P = x_A + \frac{p}{r}(x_B - x_A) \qquad y_P = y_A + \frac{p}{r}(y_B - y_A)$